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Impulsivity and Depression in Adolescent Smokers and Nonsmokers

A Senior Honors Thesis

Presented in Partial Fulfillment of the Requirements for Graduation *with Research Distinction in Psychology* in the Undergraduate Colleges of The Ohio State University

By

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Abstract

Little research has explored the relationship between depression and impulsive behavior in adolescent smokers and nonsmokers. The current study examined impulsive disinhibition, impulsive decision-making (delay discounting), and self-reported impulsivity in depressed and non-depressed adolescent smokers and nonsmokers (i.e., four groups of 15). Participants were recruited based on smoking status (verified via biomarkers for nicotine) and depression scores using a standardized self-report measure. Recommended cutoff scores for the measure of depression were used to categorize depressed and non-depressed participants. For the measure of impulsive disinhibition, the groups did not differ. On the measure of delay discounting, the non-depressed nonsmokers discounted significantly less (i.e., less impulsively) than the other three groups, while those three groups did not differ significantly. For the self-report measure of impulsivity, the non-depressed nonsmokers were again significantly less impulsive than the other three groups. However, for this measure, depressed smokers and nonsmokers were more impulsive than non-depressed smokers—suggesting depression is associated with greater impulsivity on this measure regardless of smoking status. These findings indicate that depression, even among nonsmokers, is associated with higher levels of impulsivity, although findings are different depending on the assessment of impulsivity considered. Collectively, depressed adolescents may be at a higher risk of cigarette smoking because of the association between depression and impulsivity. Future prospective research may help clarify any causal association between high levels of depression and impulsivity and the degree to which these adolescents may be at greater risk of initiating cigarette smoking.

Impulsivity and Depression in Adolescent Smokers and Nonsmokers

Smoking is the number one preventable cause of death in the United States (e.g. Centers for Disease Control and Prevention, 2002), causing nearly 1 in 5 deaths each year (Centers for Disease Control and Prevention, 2003). The vast majority of adult smokers began smoking during adolescence (e.g. Chassin et al, 1990), and approximately 4,000 adolescents smoke cigarettes for the first time each day (Substance Abuse and Mental Health Services Administration, 2005). An early age of smoking initiation predicts lower cessation rates, shorter periods of smoking abstinence, and greater dependence on nicotine (Khuder et al, 1999). For these reasons, defining the behavioral styles most associated with smoking during adolescence is important to improve prevention and treatment plans designed for this age group. However, little research has explored the relationship between impulsive behavior and depression in adolescent smokers and nonsmokers. Exploring these relations will improve our understanding of the factors associated with cigarette smoking during adolescence.

Impulsive Behavior

Impulsivity is a behavioral characteristic that is difficult to define due to its multifaceted nature. The different dimensions of impulsivity reflect different aspects of behavior (e.g. Reynolds et al, 2007). Throughout the years, impulsivity has been associated with risk taking, motor impulsiveness, sensation seeking, and reward dependence (Evenden, 1999). These individual impulsive characteristics can lead to a wide variety of addictive behaviors such as drug use and gambling (e.g. Reynolds, 2006).

There are two popular ways to assess impulsivity, through laboratory behavioral measures and self-report personality measures.

Laboratory measures provide objective models of behavior by quantifying the participant's observable behavior (Reynolds et al, 2006). Each task measures a specific type of impulsivity, assessing the actual behavior of interest. Among the laboratory behavioral tasks, there are two broad categories of impulsive behavior measured: "impulsive disinhibition" and "impulsive decision making" (Reynolds et al, 2006). "Impulsive disinhibition" refers to the inability to inhibit a prepotent response in a motor task. One of the most popular ways of measuring disinhibition is to use variations of the go-stop task. Go stop signals either activate (go) or inhibit (stop) motor processes (Logan, 1994). These tasks evaluate a participant's ability to restrain undesirable behaviors and responses. A study with undergraduates found that adults who had been identified as highly impulsive on a self-report measure had longer stop-signal reaction times, indicating poor inhibitory control. Thus, impulsiveness was found to be associated with slower inhibitory responses in a motor task (Logan et al, 1997). In another study, cocaine impaired the ability to inhibit responses to stop tasks (Fillmore et al, 2002).

The relationship between behavioral disinhibition and smoking is currently unknown because only preliminary research has been conducted. In a study with adolescent smokers, male smokers were less impulsive on a Go-Stop task than male nonsmokers, but there was no effect seen between female smokers and nonsmokers (Reynolds et al, 2007). This represents possible gender differences for the effects of nicotine on motor impulsivity. Another study suggested that stimulants may improve performance on inhibition tasks, and nicotine (as a stimulant) may be associated with

better behavioral inhibition (de Wit et al, 2002). However, further research needs to be conducted to replicate these findings.

The other defined dimension of impulsivity is "impulsive decision making" (delay discounting). Delay discounting refers to making a choice between smaller, immediate rewards or larger, delayed rewards. Choices for smaller, immediate rewards reflect greater impulsivity. There are three different kinds of delay discounting assessments: hypothetical measures, real-reward measures, and real-time measures (Reynolds, 2006). With hypothetical measures, participants are presented with a series of questions that examine their choice preferences between immediate and delayed rewards; however, participants do not experience delays or receive any compensation based on their choices. With real-reward measures, participants are presented with the same questions as in the hypothetical measure, except at the end one of their choices is randomly picked and the participant receives the monetary value of their randomly-selected choice. Adolescent smokers discounted more than nonsmokers using a real-reward measure; however, the effect size for smoking status was slightly smaller than previous studies with adults (Reynolds et al, 2007). This difference could be attributed to the finding that adolescent smokers smoke less than adult smokers, and is consistent with correlations identified between delay discounting and rates of smoking (e.g, Ohmura et al, 2005). With real-time measures, participants actively experience the consequences associated with their choices (i.e., participants receive rewards as they make choices).

In a review of delay discounting literature, Reynolds (2006) found that some studies suggest high rates of delay discounting predispose individuals to addictive behaviors, while other studies indicate that addictive behaviors can cause greater

discounting. In a study concerning alcoholics, late-onset alcoholics and non-alcoholics did not differ significantly on delay discounting measures. However, there was a significant difference between early-onset alcoholics and the other two groups (Dom et al, 2006). This suggests that higher rates of delay discounting can predispose an individual to addictive behaviors at an earlier age. The other viewpoint can be seen in a study dealing with adult smokers. In this study, ex-smokers and nonsmokers did not differ in rates of delay discounting, but current smokers did discount significantly more than the other two groups. This suggests that smoking cessation could lead to lower rates of delay discounting among ex-smokers (Bickel et al, 1999), thus indicating that addictive behaviors causing greater discounting. Causal directions are not clear; therefore further research is needed to explore the direction of effect between rates of delay discounting and addictive behaviors. Research concerning causal relationships between delay discounting and addictive behavior is extremely important in assessing treatment outcomes for adolescent smokers. One study analyzed adolescents who were part of a quit smoking treatment program, and found that those who did not quit during the program discounted more on a real-reward measure prior to the start of the program than those who had abstained from smoking during treatment (Krishnan-Sarin et al, 2006).

While laboratory behavioral measures such as delay discounting assess specific behavioral styles related to impulsivity, self-report measures provide broad descriptions of impulsive behavior. Self-report measures have multiple subscales that qualify different personality characteristics. They were developed to efficiently measure multiple characteristics that could give an overall view of an individual's level of impulsiveness (Patton et al, 1995). Although there is a wide range of self-report measures, most of them

correlate with each other at some level (Reynolds et al, 2006). Using these scales, most studies find higher impulsivity scores in substance dependent participants (e.g., Moeller et al, 2001). In a study among undergraduates, prisoners, and psychiatric patients with and without substance abuse problems, the Barratt Impulsiveness Scale identified male prisoners as being the most impulsive, followed by psychiatric and substance abuse patients, who did not have significantly different scores (Patton et al, 1995). In a second study using the Barratt Impulsiveness Scale, impulsivity was highly correlated with use of cocaine and withdrawal symptoms (Moeller et al, 2001). In a study using the Zuckerman- Kuhlman Personality Questionnaire, a three way interaction of high impulsivity, peer cigarette smoking, and alcohol use significantly predicted smoking later in life (Kelly et al, 2007). Recent research also has shown that adolescent smokers are more impulsive than nonsmokers with an adolescent version of the Barratt measure (Fossati et al, 2002).

Both ways of measuring impulsivity are correlated with depression. In a study involving delay discounting, adults who reported depressive symptoms discounted the value of delayed rewards more than those with lower reports of depression (Yoon et al, 2007). In a study with adults using a self-report measure, high impulsivity was an indicator for increased risk of a newly diagnosed depressive disorder (Granö et al, 2007). This finding can also be applied to adolescents, as depressed adolescents were rated by their parents as more impulsive than non-depressed adolescents (Cataldo et al, 2005). Further research is needed to determine the relationship between impulsivity and depression in adolescents.

Depression

In recent years, depression has become an illness that affects a large proportion of the population. Depression is the leading cause of disability among all mental illness and is the fourth largest contributor to the global burden of disease (World Health Organization, 2007). Each year, around 9.5% of the U.S. adult population suffers from some form of depression (Keesler et al, 2005). There are three recognized forms of depression: major depression, dysthymia, and bipolar disorder. Major depression is characterized by presenting at least five of the following symptoms every day for at least two weeks: depressed or irritable mood most of the day; lowered interest or pleasure in activities that used to be enjoyable; changes in sleep, eating, and energy; feelings of worthlessness or guilt; decreased ability to think and concentrate; recurrent thoughts of death; and physical agitation or slowing (DSM-IV-TR, Diagnostic and Statistical Manual). Major depressive disorder can consist of either a single episode, or it can be recurrent if it consists of two or more episodes. Dysthymia is diagnosed as a depressed mood for most of the day, more days than not, for at least 2 years. Although it spans a longer time period, dysthymia represents fewer symptoms that are less severe than a major depressive disorder. Along with depressed mood, individuals must also present two of the following symptoms: changes in appetite, sleeping, and energy; low self-esteem; trouble with thinking; and feelings of hopelessness (DSM-IV-TR). The last form of depression, bi-polar disorder, has cycling mood changes of extreme highs (i.e. mania) and extreme lows (i.e. depression) (DSM-IV). Bi-polar disorder will not be discussed in this thesis since it does not solely deal with depression. In addition, all of these disorders cause impairment in functioning in daily life to varying degrees.

Contrary to past belief, individuals can begin to develop depression during childhood and adolescence (Hankin, 2006). Most preadolescents report low levels of depressed mood, have low rates of depression prevalence (Hankin), and less than 3% have lifetime prevalence rates of depression (Cohen et al, 1993). It is more difficult to study childhood depression than adolescent depression, given the low prevalence rate and the complexity of determining depression with the multiple stages of social, behavioral, and cognitive development that occur during childhood. However, as children transition into adolescence, there are much higher levels of depressed mood and adult-like prevalence levels of depression (Cohen et al, 1993). Between 20 and 50% of adolescents report some symptoms of depression (Kessler et al, 2001), with a 14% lifetime prevalence rate among 15 to 18 year olds (Kessler et al, 1994). Depression rates start to rise in early adolescence (11 years of age) and increases until late adolescence (18 years of age) (Cohen et al, 1993), where the prevalence rate reaches adult levels at 16.6% (Kessler et al, 2005). The symptoms for a major depressive disorder are the same for adolescents as compared to adults, but the criteria for dysthmia changes to one-year prevalence rather than two year prevalence in adults (DSM-IV). Since depression is a recurring disorder, 40% of adolescents will have another episode within 3-5 years (Lewinsohn et al, 1994). For the purpose of this study, as done with many other studies (e.g.Hankin), the two kinds of depression will be combined to discuss depressive symptoms on a general level.

Most individuals diagnosed with depression experience the symptoms for the first time during adolescence, and adolescent depression serves as a predictor for depression during adulthood. There are multiple causes of adolescent depression. One explanation is

centered on the number of negative life events that occur with the onset of puberty and the stressors associated with growing up (Hankin, 2006). Genetic heritability is also important, as depression has been found to be moderately heritable starting in adolescence and continuing through adulthood (Rice et al, 2002). But, family environment, not genetics, is more strongly related to depression before age 11 (Rice). Personality vulnerability such as neuroticism, biological vulnerabilities in the brain, cognitive vulnerabilities in decision making and attitude, and interpersonal vulnerabilities in areas such as dependency and excessive reassurance-seeking have all been implicated in depression (Hankin, 2006).

Females are more depressed than males during adolescence, as well as in adulthood (e.g., Hankin et al, 1998). The differences in rates of depression between the sexes are most apparent between middle and late adolescence (Hankin et al, 2007). The association between stress and depression is high in females, and one underlying reason for the differences between sexes is attributed to coping style (Li et al, 2006). One study found that girls generally exhibited a ruminating coping style, where they continuously think about a problem to manage their stress, maintaining active depressive symptoms. On the other hand, boys generally exhibited a problem-focused coping strategy, where they directly deal with the problem and quickly get over the issue (Li). Overall, a mix of factors including neurohormonal differences, genetic factors, differences in socialization, and rumination all lead to increased depression in females (Kessler et al, 2001).

It is not uncommon for depression to be related to substance use, as drug use can be a coping mechanism to deal with depression. According to the National Longitudinal Alcohol Epidemiologic Survey (NLAES), there was a significant correlation between

every kind of drug use and major depression within adults (Grant, 1995). Also, 18.71% of those who had a drug use disorder within the last year had major depression, which is higher than the base rate for depression in the population. Associations were higher for those who were drug dependent rather than those who were abusing drugs and many people use a variety of central nervous system depressant drugs as self-medication for depression. These drugs initially produce euphoria, but over time they can lead to increased depression symptoms (Grant). These findings are similar for adolescents. A longitudinal study found there is a significant difference in rates of substance abuse between adolescents with and without depression (Costello, 1999).

Depression and smoking have a complex relationship. First, smokers have the highest levels of depression, followed by former smokers and non-smokers (Martini et al, 2002). Depression is a risk factor for smoking initiation in adolescents, and depression can increase vulnerability to becoming a smoker from societal pressures like tobacco advertising and peer smoking (Munafó, 2007). In girls, depression increases the risk for daily smoking only in those who were nonsmokers, but in boys both smokers and nonsmokers with depression have an increased risk of daily smoking (Patton et al, 1998). Also, cigarette smoking in adolescent males leads to a decreased effect of stress on depression, suggesting that smoking could be a coping mechanism for stress and depression in males (Koval, 2004). However, this has not been found for females or younger males, as peer pressure may be a much more influential factor in smoking for these groups (Koval). Also, current smoking and smoking initiation are predictors for developing depressive symptoms (Munafò). Thus, there appears to be an interrelated dynamic between depression and smoking in adolescents.

The current research explored relations between impulsive behavior and depression in adolescent smokers and nonsmokers. Given past research (Reynolds et al, 2007), we expected that smokers would be more impulsive than nonsmokers on both laboratory behavioral and self-report measures. We also expected that depressed participants would be more impulsive than non-depressed participants, as shown with adults (Yoon et al, 2007). We hypothesized that the relationship between impulsivity and smoking would be additive. That is, depressed smokers would be the most impulsive, followed by non-depressed smokers and depressed nonsmokers, with these two groups not differing. Finally, we expected that non-depressed nonsmokers would be the least impulsive. Such cross-sectional findings would indicate that smoking status and depression interact additively with impulsivity. This study constitutes an important first step in defining the relationship between impulsive behavior, depression, and cigarette smoking during adolescence.

Methods

Participants

A total of sixty adolescents ranging between 14 and 17 years of age were recruited from advertisements placed in a local newspaper and a database maintained at Nationwide Children's Hospital. Participants within the specified age range were recruited based on smoking status (verified via biomarkers for nicotine) and depression scores using the Beck Depression Inventory (Beck, 1996). Recommended cutoff scores for the measure of depression were used to categorize depressed and non-depressed participants. Thus, the participants were recruited to form four groups : depressed

smokers (*n*=15; those smoking at least one cigarette per day who were classified as depressed), non-depressed smokers (*n*=15; those smoking at least one cigarette per day who were not classified as depressed), depressed nonsmokers (*n*=15; those who had never smoked cigarettes who were classified as being depressed) and non-depressed nonsmokers (*n*=15; those who had never smoked cigarettes who were not classified as being depressed).

Dependent Measures

Impulsivity

Go-Stop task (Doughtery et al, 2003). This is a laboratory behavioral task that measures "behavioral inhibition", or the ability to inhibit prepotent motor responses. Motor control is analyzed by being presented with a series of three-digit numbers on a computer screen (eg., 246, 425, 363). A one second blank screen separates each three-digit-number. Participants completed 240 trials where they were instructed to respond as fast as possible when a matching three-digit number appeared on the screen (go signal). For clicking on a matching number, participants earned $.05 for each go signal response that occurred when the matching number was visible (400 ms), but lost .05 for late responses that occurred after the number had already disappeared from the screen. When a participant clicked a non-matching number, he or she lost 10 cents. If 40% or more of the go signal responses are late, the participant's data are invalid.

In another phase of the test, the second matching number changes color from black to red 25% of the time, indicating a stop trial. Participants are told to not click the left mouse button when the second number flashes to red and earned $.05 for each

successful inhibited response. Five cents were lost when one clicked at the improper time. These color changes happen after different intervals within the 400 ms of a go signal. The stop signal intervals vary as a function of task performance. Interval lengths decrease following failures to inhibit but increase when one succeeds in inhibiting. Stop signals adjust until the subject is able to withhold click response on around half of the stop-signal trials. At 50%, the stop reaction time (RT) is analyzed by subtracting the stop-signal delay from the go signal RT. Thus, longer stop RTs reflect more behavioral disinhibition and more impulsivity.

Question-based delay-discounting measure (Richards et al, 1999). This computerized task calculates the rate at which a participant chooses a smaller, immediate reward over a larger, delayed reward (eg., Would you rather receive 5 dollars now or 10 dollars 30 days from now?). The delayed amount of money is fixed at $10 and is set at different time periods: 1, 2, 30, 180, and 365 days. The amount of immediate money offered varies each trial based on an adjusting amount procedure. The immediate money is adjusted randomly across questions by $\pm$ .50 cents until an indifference point between the delayed and immediate is reached across each delayed time period. The indifference point is the amount at which the smaller, immediate reward is equal to the larger, delayed reward. These indifference points can be plotted to form the overall delay discounting curve. Participants are told their choices are important, because at the end of the task one question will be randomly selected and paid. If the randomly selected choice was for immediate money, the participant will receive the money that day. Otherwise, the money earned will be mailed after the specified delay.

Barratt Impulsiveness Scale 11 (Adolescent Version) (BIS-11-A; Fossati et al, 2002). This is a 30 item self-report of impulsive characteristics that has been adapted for adolescent use from the original adult version (Patton, Stanford, & Barratt, 1995). The BIS-II-A is divided into six subscales: Motor Impulsiveness, Cognitive Complexity, Self-Control, Lack of Delay, Attention, and Perseverance. Intercorrelations among these factors for adolescents are significantly higher for the factors of the BIS-11 than for adults. Thus, BIS-II-A total scores are recommended to be the best indicator of impulsivity in adolescents. The original study cited that internal consistency was adequate with adolescents, with a Cronbach's alpha of .78 (Fossati et al., 2002).

Depression

Beck Depression Inventory: Second Edition (BDI-II) (Beck, 1996). This is a 21 item self-report questionnaire which assesses the symptoms and severity of depression according to American Psychiatric Association's *Diagnostic and Statistical Manual of Mental Disorders* Fourth Edition (DSM-IV; 1994). Each item represents a symptom of depression and is scored on a 4 point scale (0-3). Each question asks the participant if the specific symptom has occurred for the "past two weeks-including today". The BDI-II was modified from the BDI based on changes in the DSM. The BDI- II is seen as more reliable compared to its first edition, based on the fact that the Coefficient Alpha (.92) of the BDI-II is higher than the BDI (.86). According to the diagnostic manual, a total score of 0-13 is considered minimal range, 14-19 is mild, 20-28 is moderate, and 29-63 is severe. This study used a score of 14 as the minimal score to indicate depression.

Therefore, all participants with a score of 13 and under were classified as non-depressed groups and all participants with a score of 14 and higher were classified as depressed groups. The BDI-II was compared against a standard for measuring depression in adolescents, the Reynolds Adolescent Depression Scale (II) and the correlation on the total scores of the measures was .84. (Krefetz et al, 2002).

Procedure

Before participation, informed consent was signed by a parent or legal guardian, and assent was obtained from the adolescent. All data collection took place between 12:00 pm and 8:00 pm. Smoking status was verified using exhaled carbon monoxide (CO) and urinary cotinine content (a metabolite of nicotine). Smokers were required to have CO levels above or equal to 4 ppm and cotinine levels above or equal to 200 ng/ml. Nonsmokers were required to have CO levels at or below 3 ppm and cotinine levels at or below 50 ng/ml. Following smoking status verifications, participants completed the Kaufman Brief Intelligence Test: Second Edition (KBIT-2) (Kaufman and Kaufman, 2004) to assess verbal and non-verbal ability. Participants then completed self-report measures that assessed depression and impulsivity. Next, the different types of impulsive behavior were assessed using standardized laboratory measures (see Dependent Measures). After completing the experiment, participants were debriefed and compensated for their participation. Payment ranged from 25 to 35 dollars and was partially based from performance on laboratory-behavioral tasks.

Data Analyses

An area-under-the-curve (AUC) method, described by Myerson, Green, and Warusawitharana (2001), was used to analyze data from the measure of delay discounting. Values of AUC are determined by graphing the five indifference points generated by the participant's choices, forming a discounting curve. The curve forms four separate quadrants based on the length of delay: Quadrant one involves the 1 and 2 day delays; Quadrant two is between the 2 and 30 day delays; Quadrant three represents the area between the 30 and 180 day delays, and Quadrant four is between the 180 and 365 day delays. The AUC value of each of these four quadrants can be added together to calculate the total. Using this method, smaller AUC values indicate greater discounting and impulsivity, and thus larger AUC values indicate less discounting and impulsivity. The discounting data were inspected for normality by using Shapiro-Wilks tests. The data were not normally distributed, and they were thus log transformed to improve normality.

SPSS version 17.0 was used for all statistical analyses. Race is a categorical variable, and was analyzed using Chi-Square testing. All other comparisons were made using separate one-way analyses of variance (ANOVAs). LSD post-hoc tests were used to examine the specific differences between each of the four groups. These analyses utilized smoking and depression status as the grouping variables.

Results

Participant Demographics

Self-reported demographics and drug use data are presented in Table 1. The two smoking groups had significantly higher CO and cotinine levels than nonsmokers, thus

providing verification of smoking status classifications (p=.001). Further, non-depressed smokers had significantly higher CO levels than depressed smokers (p=.023), but cotinine levels did not differ within smoking status. Groups significantly differed on the Beck Depression Inventory [F= 59.79, p=.001]. As expected, the two depressed groups had significantly higher levels of depression than the non-depressed groups. Further, depressed smokers had significantly higher levels of depression than depressed nonsmokers (p=.015). The two non-depressed groups did not differ in depression.

There were group differences in self-reported drug use and certain demographic characteristics. Both groups of smokers had significantly higher rates of using cigarettes, marijuana, and alcohol than the two groups of nonsmokers (p=.001 for all measures). Depressed smokers reported significantly more marijuana use than non-depressed smokers (p=.007). There were no other differences in drug use within the smoking and nonsmoking groups. The four groups significantly differed by age [F = 2.773, p= .050]. Non-depressed smokers were significantly older than both depressed nonsmokers (p=.011) and non-depressed nonsmokers (p=.027), but these smokers did not differ from depressed smokers. Overall, groups differed by median household income [F= 2.79, p= .049]. Depressed nonsmokers had significantly higher estimated incomes than depressed smokers (p=.009) and non-depressed smokers (p=.031). Groups did not differ by gender, IQ, or race.

Table 1

Participant Demographics and Drug Use Summaries (N=60)

	Smokers		Nonsmokers	
	Depressed	Non-depressed	Depressed	Non-depressed
Demographics				
Sex (%; female)	86.67_{a}	73.33_{a}	93.33_{a}	73.33_{a}
Age [years; *M* (*SD*)]	$15.86\ (.83)_{a,\ b}$	$16.33\ (.97)_{a}$	$15.4\ (1.18)_{b}$	$15.53\ (.83)_{b}$
Race (n; white:black:other)	$9{:}5{:}1_{a}$	$9{:}5{:}1_{a}$	$9{:}4{:}2_{a}$	$3{:}11{:}1_{a}$
Annual Household Income ($; Median)*	$47{,}192.00_{a}$	$54{,}473.00_{a}$	$64{,}379.00_{b}$	$53{,}193.00_{a,\ b}$
Carbon Monoxide [ppm; *M* (*SD*)]	$7.73\ (5.20)_{a}$	$10.86\ (4.91)_{b}$	$1.53\ (1.30)_{c}$	$1.8\ (1.08)_{c}$
Cotinine [ng/ml; *M* (*SD*)]	$1{,}300\ (982)_{a}$	$1{,}000\ (541)_{a}$	$0.00\ (0.00)_{b}$	$0.00\ (0.00)_{b}$
BDI [*M* (*SD*)]	$26.26\ (8.31)_{a}$	$6.46\ (4.05)_{b}$	$21.06\ (6.06)_{c}$	$5.06\ (2.65)_{b}$
KBIT [IQ*; M* (*SD*)]	$87.4\ (13.00)_{a}$	$85.8\ (13.90)_{a}$	$93.93\ (8.58)_{a}$	$93.26\ (11.62)_{a}$
Drug Use [*M (SD)*] **				
Cigarettes (number per day)***	$6.26\ (5.27)_{a}$	$6.63\ (4.23)_{a}$	$0.00\ (0.00)_{b}$	$0.00\ (0.00)_{b}$
Alcohol	$1.4\ (1.05)_{a}$	$1.13\ (1.12)_{a}$	$.33\ (.62)_{b}$	$.33\ (.81)_{b}$
Marijuana	$2.4\ (1.63)_{a}$	$1.4\ (1.05)_{a}$	$0.00\ (0.00)_{b}$	$0.06\ (.25)_{b}$

Note. Means in the same row that do not share the same subscript differ at $p < .05$ * The median annual household income was calculated based on average income for postal zip code region of the participant's residence. ** Except where otherwise specified, drug use was assessed with the following question: "Thinking about the past six months, how often have you used the following substances?": 0 = *never tried*, 1 = *tried it*, 2 = 1-2 *times/month*, 3 = *once a week*, 4 = 2-4 *times/week*, 5 = *5 or more times a week*. *** Cigarettes per day were calculated using a timeline followback calendar to determine cigarettes smoked each day during the past 14 days.

Dependent Measures

There were no significant group differences on the Go Stop Task [F=1.105, *p*=.355]. Figure 1 shows group averages for stop latency.

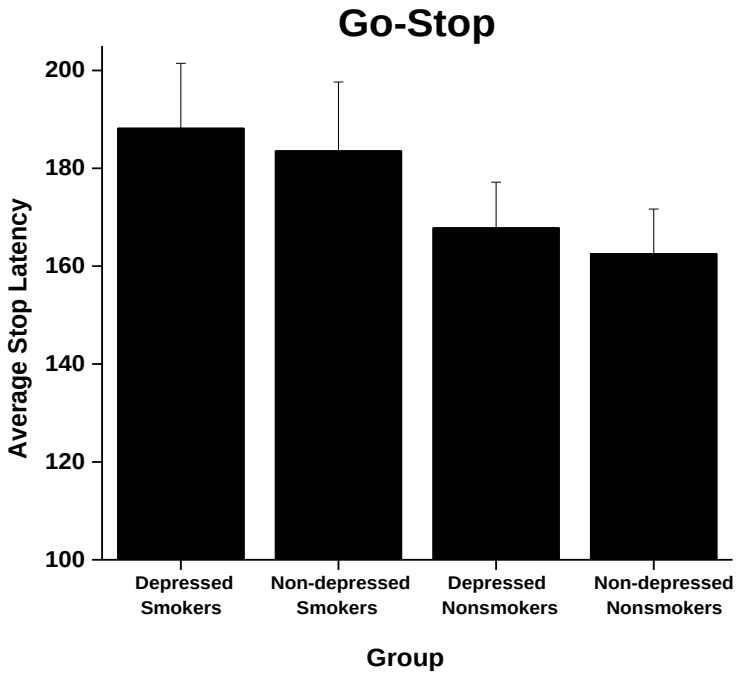

Figure 1: Go-Stop Average Stop Latency Scores for Depressed Smokers, Non-depressed Smokers, Depressed Nonsmokers, and Non-depressed Nonsmokers

Delay discounting significantly differentiated the four groups [F= 2.270, *p*=.045]. Post hoc analyses showed that non-depressed nonsmokers discounted significantly less than non-depressed smokers (*p*=.018), and approached significant difference from depressed nonsmokers (*p*=.051). The two smoking groups and the depressed nonsmokers did not differ from each other. Figure 2 shows the median indifference points at each delay for each of the four groups.

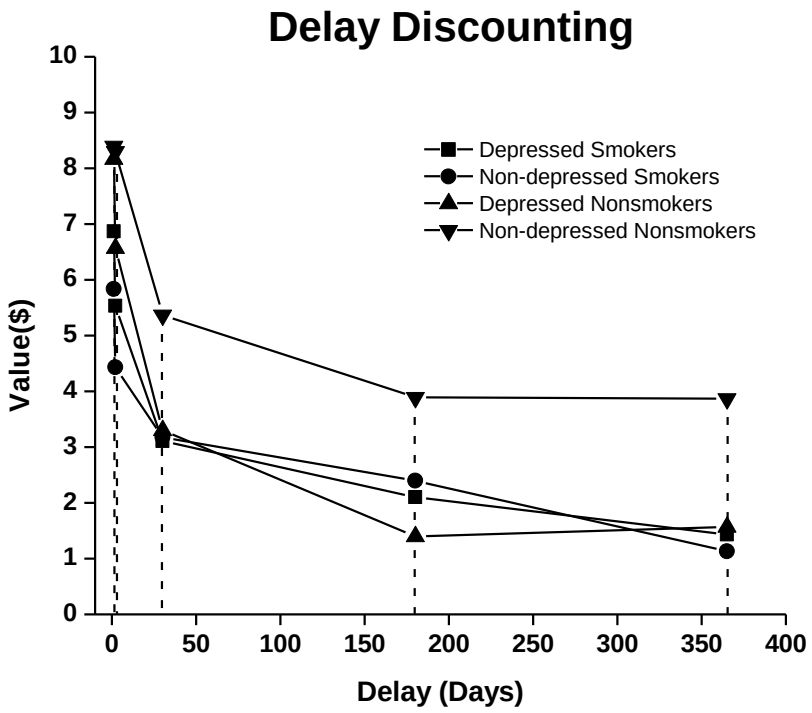

Figure 2: Delay Discounting Indifference Points Among Depressed Smokers, Non-depressed Smokers, Depressed Nonsmokers, and Non-depressed Nonsmokers

Considering the different quadrants of the discounting curves, there were significant group differences in quadrant four, between the 180 and 365 day delays [F=2.890, *p*=.043]. Non-depressed nonsmokers were significantly less impulsive than non-depressed smokers (*p*=.020) and depressed nonsmokers (*p*=.010). Non-depressed nonsmokers also were less impulsive than depressed smokers, but not at a significant level (*p*=.062).

The self-report measure of impulsivity, the BIS-11-A, also significantly differentiated the four groups [F=11.77, *p*=.001]. Again, the non-depressed nonsmokers were significantly less impulsive than the depressed smokers (*p*=.001), non-depressed

smokers (p=.006), and depressed nonsmokers (p=.001), as seen in Figure 3. Depressed smokers were significantly more impulsive than non-depressed smokers (p=.015), and depressed nonsmokers were more impulsive than non-depressed smokers (p=.050). Depressed smokers and depressed nonsmokers did not differ in levels of impulsivity (p=.608).

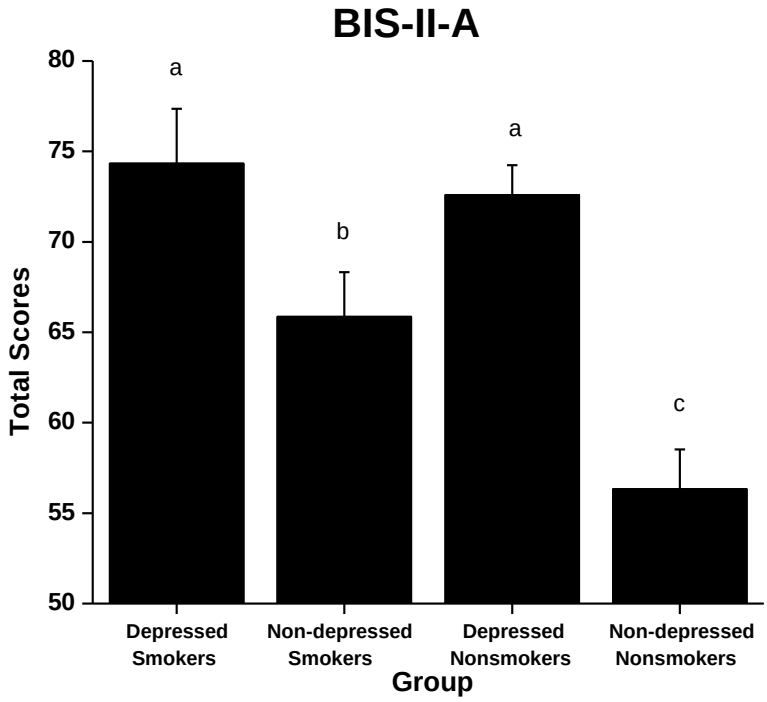

Figure 3: BIS-11-A Ratings of Depressed Smokers, Non-depressed Smokers, Depressed Nonsmokers, and Non-depressed Nonsmokers

From Table 1, there were significant group differences in age and median annual household income. To test if these differences accounted for the significant effects found with the measure of delay discounting and the self-report measure of impulsivity, these analyses were repeated while controlling for differences in age and income as covariates. Group differences remained significant for both the measure of delay discounting and the BIS-11-A after controlling for age and income.

Correlation Analyses

The measure of delay discounting and the BIS-11-A were not correlated with each other, confirming previous literature that laboratory behavioral measures and the self-report measures test different aspects of impulsivity (Reynolds et al, 2006). Also, depression and delay discounting were not correlated. However, the BDI was positively correlated with the BIS-11-A and the measure of impulsive disinhibition, as shown in Table 2.

Table 2

Correlation matrix for all measures of depression and impulsivity (N = 75)

	1	2	3	4
1	1.0	.493**	-.117	.257 *
2		1.0	-.095	.048
3			1.0	-.023
4				1.0

1. BDI Total ; 2. BIS-11-A ; 3. DDQ ; 4. Go-Stop

Note: $^{*}p < .05$ (two-tailed test); $^{**}p < .01$ (two-tailed test)

Discussion

This study explored the relationship between assessments of impulsivity and depression in adolescent smokers and nonsmokers. The hypothesis that the relationship between smoking status and depression would be additive for impulsivity was not confirmed with any of the measures of impulsivity. The measure of impulsive

disinhibition (Go-Stop task) did not significantly differentiate any groups. However, correlation analyses showed that this task was positively correlated with scores on the measure of depression (BDI-II). This positive correlation suggests that greater depression was associated with an inability to inhibit prepotent motor responses.

Delay discounting did significantly differentiate the four groups. Depressed smokers, non-depressed smokers, and depressed nonsmokers did not differ. These three groups discounted more impulsively than the non-depressed nonsmokers. These findings indicate that depressed nonsmokers discounted delayed rewards similarly to smokers. Also, depression did not have an added effect on levels of impulsivity in smokers (i.e., depressed smokers did not discount most). This finding is not consistent with an earlier study, where depressed smokers discounted more impulsively than non-depressed smokers (Yoon et al, 2007). Overall, smoking status and depression seemed to have an equal effect on levels of delay discounting.

Findings with self-reported impulsivity also did not confirm the initial hypothesis. Depressed smokers and depressed nonsmokers rated themselves as more impulsive on the BIS-11-A than non-depressed smokers and non-depressed nonsmokers. The two depressed groups did not differ. This finding indicates that depressed smokers are significantly more impulsive than non-depressed smokers. This relationship between depression and impulsivity has been shown previously in spontaneous quitters (Yoon et al, 2007); however, the previous study found this relationship with a measure of delay discounting. The current study only found this relationship with the self-report measures of impulsivity. Non-depressed smokers were also significantly more impulsive than the non-depressed nonsmokers. This indicates that depression may be associated with greater

levels of impulsivity than smoking status. However, when not depressed, smokers were more impulsive than nonsmokers. Also, correlation analyses showed that the BIS-11-A was positively correlated with scores of depression. This indicates that participants with higher levels of depression were rated as more impulsive compared to those with lower levels of depression.

The study by Yoon et al (2007) differed from the current study. The current study recruited adolescent smokers and nonsmokers, while the earlier study measured delay discounting in relation to depression in adult women who were less than 25 weeks pregnant and who were "spontaneous quitters". Spontaneous quitters were defined as expectant mothers who had quit smoking after discovering they were pregnant, but before their first prenatal medical visit. It is unknown whether "spontaneous quitters" resemble smokers, nonsmokers, or if they represent a unique population.

Findings were different depending on the measure of impulsivity used. These differences, and the finding that the two measures were not correlated, confirm previous conclusions that self-report measures and laboratory behavioral measures of impulsivity assess different aspects of impulsivity (e.g., Reynolds et al, 2006). On the measure of delay discounting, depressed smokers, non-depressed smokers, and depressed nonsmokers did not differ. However, on the BIS-11-A, non-depressed smokers were significantly less impulsive than the depressed groups.

For the BIS-11-A, depression may affect a person's self- perception in a manner than influences ratings of impulsivity. Depression is characterized by hopelessness, a sense of worthlessness, and anhedonia (DSM-IV). Due to these negative feelings about onself, depressed participants may have rated themselves more harshly on items

involving attention, responsibility, and the future. Non-depressed smokers may be more optimistic about their behavior and the future, and thus may have had lower ratings of impulsivity compared to the depressed groups. Feelings about oneself may have less impact on the actual choice behavior assessed with the measure of delay discounting and may therefore account for the observed differences between these two assessments.

The delay discounting results might be partially attributable to time perspectives. The current delay discounting findings would indicate that both smokers and those who are depressed are more immediately oriented. That is, these groups discounted more by delay and we can therefore conclude that their behavior is more controlled by immediate circumstances. Smokers, as a group, may prefer instant rewards and may not think about the long term consequences of their actions, thus increasing their initial risk of smoking. In terms of depression, those who are depressed feel hopeless about the future, so they may not think about long term consequences and may seek ways to immediately cope with their feelings of worthlessness. Depressed adolescents may therefore seek risky behaviors to temporarily elevate mood. Thus, depressed nonsmokers may discount rewards similarly to smokers in order to elevate their mood and receive immediate gratification.

The self-report measure of impulsivity could be explained by examining specific personality based dimensions of impulsivity. A study by Swann (2007) showed that on the adult version of the BIS-11, depression was related to nonplanning and attentional impulsivity. While the adult version and adolescent version of the BIS-11 are different, this explanation could help explain possible reasons for our findings. Attentional impulsivity is a lack of cognitive persistence and inability to tolerate cognitive

complexity (Patton et al, 1995). Since depression is related to decreased ability to think or concentrate, low energy, and lowered interest or pleasure in activities that used to be enjoyable, adolescents may be high in attentional impulsivity (DSM-IV-TR). The aspects of depression involving feelings of worthlessness and hopelessness may contribute to nonplanning impulsivity. Unfortunately, these subscales could not be specifically examined in the current study due to literature suggesting that, with adolescents, these subscales are too inter-correlated to be valid (Fossatti et al, 2002). Even with this recommendation, future research should be geared towards identifying the dimensions of impulsivity specifically related to depression in adolescents.

A limitation of the study was the small sample size (n=60). Several of the effects were not significant or barely significant. With a larger sample size, it is possible that some effects would become significant or increase in significance. Another limitation is that these adolescents were not clinically screened for depression. While the Beck Depression Inventory is a valid measure for assessing depression, in order to more fully confirm depression status it would be necessary to have a diagnosis from a trained mental health professional. Also, participants were not screened for use of anti-depressants. Therefore, some of the non-depressed participants may have previously been depressed and been different in terms of history of depression than the majority of the non-depressed participants. We are not certain how such a scenario would influence results. Another limitation is that an equal number of males and females were not obtained for the current study. Initially, an effort was made to recruit equal numbers of each gender; however, depressed males were a rarity. The lack of depressed males is consistent with previous studies that have found females are more depressed than males during

adolescence (e.g., Hankin, 2006) -especially during middle and late adolescence (Hankin et al, 2007).

Considering prevention and treatment implications for adolescent smoking, depressed adolescents receiving treatment for depression should be specifically counseled on smoking prevention. Depression is associated with high levels of impulsiveness and susceptibility to peer pressure. Therapy concerning specific ways to cope with impulsive tendencies and peer pressure would be useful to reduce risk of smoking initiation and increase smoking cessation (Munafó et al, 2007). One study analyzed changes in children's impulsive behavior with cognitive behavioral therapy or an attentional placebo therapy (Kendall and Wilcox, 1980). For the cognitive behavioral therapy, therapists showed children appropriate problem solving behavior by modeling. Response-cost contingency also was used to prevent rewarding of fast (or impulsive) guesses and encourage children to think through their answers. The cognitive behavioral therapy was divided into two approaches. Children received either the concrete approach, which related problem solving to the specific task at hand, or the conceptual approach, which generally taught problem solving to any situation. Results showed that the conceptual approach led to greater change in children's behavior than the other two approaches. Therefore, cognitive behavioral therapy implementing self instruction and modeling using a general problem solving approach can help children develop self-control and reduce impulsivity. Concerning peer pressure, a longitudinal study tested the effectiveness of three different smoking prevention programs in high schools (Bryne and Mazanov, 2005). The study analyzed initiation of smoking by those enrolled in the programs across three separate time periods. The results indicated that a social skills

program was more successful in controlling smoking behavior than a fitness or health program. Some of the topics discussed in the social skills program included smoking as a social behavior, peer pressure to smoke, resistance to peer pressure, and smoking and social confidence. Such an approach may be particularly useful for adolescents who are depressed, and as a result more susceptible to peer pressure.

In summary, this study provides evidence that adolescent nonsmokers with depression are as impulsive, or more impulsive depending on the measure used, as smokers. That is, depressed nonsmokers discount delayed rewards similarly to smokers, and depressed nonsmokers have similar ratings of impulsiveness as depressed smokers, but greater ratings than non-depressed nonsmokers. Overall, depression is associated with higher levels of impulsivity, and depressed adolescents have been shown to be at a higher risk of cigarette smoking initiation. Greater impulsivity in depressed adolescents may be responsible for the relationship between depression and smoking. Future prospective research may clarify any causal associations between high levels of depression and impulsivity and the degree to which these adolescents are at greater risk of initiating cigarette smoking.

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Appendix A

ASSENT TO PARTICIPATE IN A CLINICAL RESEARCH STUDY

STUDY TITLE: Correlates of Cigarette Smoking Status in Adolescents

STUDY SPONSOR: The Research Institute at Nationwide Children's Hospital

THE PERSON IN CHARGE OF THIS STUDY: Dr. Brady Reynolds, PH.D.

SUBJECT'S NAME: _____ DATE OF BIRTH: _____

We invite you to be in a research study at Nationwide Children's Hospital. We want you to read and understand some things about being in this research study:

- **It's o.k. to say "no" if you don't want to be in the study.**
- **You are allowed to quit being in the study any time.**
- **We have to explain the study to you so you can understand it. You can ask questions.**

1. WHY ARE WE DOING THIS RESEARCH STUDY?

We are doing this research to help us better understand risk factors related to cigarette smoking status in teens.

2. WHAT WILL HAPPEN DURING THE STUDY?

The study will take place with one visit to Nationwide Children's Hospital which will take about 2 to 2.5 hours. During this visit you will complete 12 questionnaires, 5 computer tasks, 2 face-to-face interviews, and complete a learning, thinking and problem-solving task. You will also be asked to provide a breath and urine sample. These samples will be used to test for cigarette smoking **only**.

When you arrive, you will start the session by giving a breath and urine sample. Then you will complete a learning, thinking, and problem-solving task that take about 30 minutes to complete. After this you will take a 5 minute break. Then you will spend about 35 minutes completing paper and pencil questionnaires. Some of these questionnaires ask questions about teens' attitudes of cigarette smoking. Others ask questions about mood. When you are finished with these, you will take another 5 minute break. After the break you will complete a group of computer tasks that will take about one hour. These computer tasks will give you the opportunity to earn money based on the choices you make while doing the tasks. You will get to keep the money you get from these tasks.

If you decide to quit the study before finishing the computer tasks, you will get to keep whatever amount of money you had earned up to that point.

Participation events for you:

Session activities (2-2.5 hours):

Child:

1. Give urine and breath samples (about 5 minutes).
2. Complete learning, thinking and problem-solving task (about 30 minutes).
3. Break (about 5 minutes).
4. Complete paper questionnaires (about 35 minutes).
5. Break (about 5 minutes).
6. Complete computer tasks (about 1 hour).
7. Reimbursement.

3. WHAT IF YOU DON'T WANT TO BE IN THE STUDY?

You can say "no" to being in the study if you want. You can also drop out of the study anytime you want.

4. WHAT ELSE DO I NEED TO KNOW?

This study will be done at Nationwide Children's Hospital or data collection will occur in the mobile research lab. The mobile research lab will be clearly marked with Nationwide Children's Hospital logos and will read "Behavioral Research Lab" on the vehicle. For data collection the mobile research lab will be parked either at Nationwide Children's Hospital, a public place, or at a participant's residence.

Sometimes doctors write papers about research studies when they are done. If a paper is written about this research study, your name won't be used in it. We will keep your information private. People who work for The Research Institute at Nationwide Children's Hospital, the study sponsor, and government agencies will be able to look at your medical information. All information collected during the sessions will be kept private. No information collected will be shared with parents.

There is no cost to you or your parents to be in this study. You will be compensated for the amount of time you spend and any discomforts you may have while participating in this study.

I have read this form. I have had a chance to ask questions about things I don't understand. I want to be in this research study and understand what will happen to me.

Signature of the Subject	Date
Signature of the Person Obtaining Assent	Date

If you have questions about the study, you can call Dr. Brady Reynolds or a member of the study staff at (614) 722-3549.

CONSENT TO PARTICIPATE IN A CLINICAL RESEARCH STUDY

STUDY TITLE: Correlates of Cigarette Smoking Status in Adolescents

STUDY SPONSOR: The Research Institute at Nationwide Children's Hospital

STUDY DOCTOR: Brady Reynolds, Ph.D.

CONTACT TELEPHONE NUMBER: 614-722-3549 (24 hours a day, 7 days a week)

SUBJECT'S NAME: _____ DATE OF BIRTH: _____

NOTE: The words "you" and "your" are used in this consent form. These words refer to the study volunteer whether a child or an adult.

1) INTRODUCTION

We invite you to be in this research study. Please learn enough about this research study, its risks and benefits, to decide whether you should agree to participate. We must explain the study to you, and give you a chance to ask questions about anything you do not understand. This process is called "informed consent". It is up to you to choose if you want to be in this study. You may refuse to be in this study or quit this study at any time, and standard medical care will still be available here or at a doctor of your choice without a penalty or loss of benefits to you. It is important to understand that there may not be any benefit from being in this study, but we may learn something that could help others.

Before agreeing to participate, it is important to read and understand the study information in this consent form**.** By signing the consent form, you agree to be in this study. If this study involves a child between 9 and 18 years of age, he/she must also agree to be in the study by signing an Assent form or on the assent line of this form. You will be given a signed and dated copy of the consent and the assent form.

2) WHY ARE WE DOING THIS RESEARCH STUDY?

This study is intended to help us better understand risk factors related to smoking in adolescents. It is expected that we will be able to identify some of the most influential risk factors of smoking cigarettes and use this information to develop better forms of treatment and prevention.

3) <u>WHERE WILL THE STUDY BE DONE AND HOW MANY SUBJECTS WILL TAKE PART?</u>

This study will be done at Nationwide Children's Hospital. About 175 subjects will take part in this study. All 175 subjects will participate here at Nationwide Children's Hospital.

4) <u>WHAT WILL HAPPEN DURING THE STUDY AND HOW LONG WILL IT LAST</u>?

This study will involve an initial visit to Nationwide Children's Hospital, for a research session that will last about 2 to 3 hours. First, the subject will blow into a hand-held meter, which will show if he/she recently smoked a cigarette. The subject also will give a sample of urine, which will later be tested to see if cigarettes have been smoked recently. A saliva sample also will be collected for genetic analyses related to cigarette smoking.

Next, the subject will complete questionnaires. Completing these questionnaires will take about 30 minutes. Some of the questionnaires include personal questions, but these questions will not be tied to your name or other identifying information. All questionnaires will be kept confidential by using an ID number and stored in a locked file cabinet. After the questionnaires are done, the adolescent will then complete computer tasks. This will take about 1 ½ hours.

After completing the computer tasks, any questions about the study will be answered.

Teens will be reimbursed for this session based on computer-task performance (between $25 and $35 each). These computer tasks offer the opportunity to earn money based on choices made during the tasks. If the adolescent decides to quit the study before completing all of the computer tasks, he or she will get to keep whatever money had been earned to that point, with a minimum of $25. $5 will be allotted for travel expenses.

Session activities (2-2.5 hours):

Teen:

8. Give urine and breath samples (about 5 minutes).
9. Complete learning, thinking and problem-solving tasks (about 30 minutes).
10. Break (about 5 minutes).
11. Complete paper questionnaires (about 35 minutes).
12. Break (about 5 minutes).
13. Complete computer tasks (about 1 hour).
14. Reimbursement.

5) <u>WHAT BAD THINGS CAN POSSIBLY HAPPEN DURING THIS STUDY</u>?

Being in this study involves little risk to the subject. All data will be coded with subject numbers so that the data will be separate from personally identifying information. However, loss of confidentiality is possible but all steps will be taken to avoid loss of confidentiality.

Some of the computer tasks may become boring, but the subject is able to withdraw from the study at anytime during the procedure. The participant can keep whatever money had been earned to the point of quitting the study.

There may be other risks of being in this research study, which are not known at this time.

6) WHAT GOOD THINGS CAN POSSIBLY HAPPEN DURING THIS STUDY?

There may be no benefit from being in this study, but we might learn something that could help others.

7) WHAT HAPPENS IF BEING IN THIS STUDY CAUSES INJURIES?

If being in this study causes an injury, Nationwide Children's Hospital will provide medical care. You or your insurance company may have to pay for the cost of this care. This does not mean that you give up any of your rights under state or federal laws to ask for this care to be paid by someone else.

8) OTHER IMPORTANT INFORMATION

Being in more than one research study at the same time may cause injury. You should tell the Study Doctor about being in any other research study. The Study Doctor will decide if it is OK to be in more than one study at the same time.

9) SPECIAL INFORMATION ABOUT PREGNANCY: N/A

10) WHAT WILL HAPPEN IF NEW INFORMATION IS FOUND OUT ABOUT THE DRUG OR TREATMENT? N/A

11) WHAT OTHER TREATMENTS ARE THERE? N/A

12) WHAT WILL HAPPEN IF I DO NOT FINISH THIS STUDY?

It is your choice to be in this study or to stop at any time. If you decide to stop being in this study, it is OK, but you must call the study doctor or the study coordinator.

If you stop being in the study, there will not be a penalty or loss of benefits to which you are otherwise entitled.

13) WILL THERE BE ANY COSTS TO ME?

It will not cost you anything to be in this study. You will be reimbursed for parking while you are in this study.

You will be compensated between $25 and $35 in cash at the end of participation. The specific amount of compensation depends on task performance while in the study.

Also, if you decide to withdraw from the study, you will get to keep all money earned up to the point of withdrawing from the study.

14) HOW WILL MY STUDY INFORMATION BE KEPT PRIVATE?

Information collected for this study is confidential to the extent provided by law. Each participant will be assigned a participation identification code. In the event of any publication regarding this study, your identity will not be revealed. Employees from the following organizations may receive copies of the study records:

- Dr. Brady Reynolds and his employees
- The Office for Human Research Protections (OHRP)
- The Institutional Review Board (IRB) of Children's Research Institute (a committee that reviews all research)

Because of the need to give information to these people, absolute confidentiality cannot be guaranteed. Information given to these people may no longer be protected by federal privacy rules.

- **Protected Health Information that may be used or disclosed:**

- Breath- and urine-sample results related to cigarette smoking
- Self reports of recent drug use
- All data generated from the questionnaires completed during participation
- All data generated from the behavioral tasks completed during participation
- All demographic data (for example, age, sex, race) collected during participation

Reason(s) why the use or disclosure is being made:

Exceptions to confidentiality would include any significant information about child abuse or neglect as well as reports that suggest you or someone else would be placed in a potentially life threatening situation if confidentiality were not breached.

Also, if your child expresses any suicidal thoughts, feelings, or behaviors we will report this to the Suicide Prevention Team located at Nationwide Children's Hospital. You will be notified if this occurs. If the Suicide Prevention Team believes other authorities need to be contacted they will not hesitate to do so and will inform you of this as well.

If you have a bad outcome or adverse event from being in this study, the Study Director and staff or other health care providers may need to look at your entire medical records.

The PHI collected or created under this research study will be used/disclosed as needed until the end of the study. The records of this study will be kept for an indefinite period of time.
You may decide not to authorize the use and disclosure of your PHI, however, if it is required for this study, you will not be able to be in this study. If you agree to be in

this study and later decide to withdraw, you may also withdraw your authorization to use your PHI. This request must be made in writing to the Study Director. If you withdraw your authorization, no new PHI may be collected and the PHI already collected may not be used unless it has already been used or is needed to complete the study analysis and reports.

15) WHOM SHOULD I CALL IF I HAVE QUESTIONS OR PROBLEMS?

If you have questions about anything while on this study, you have 24 hour access to leave a message to your Study Doctor at 614-722-3549. Your call will be returned within 24 hours.

If you have questions or are worried about your rights as a research volunteer, please call (614) 722-2708, Children's Hospital, Institutional Review Board, (IRB, a committee that reviews all research).

Subject's Name _____ **Date of Birth**_____

SUBJECT or SUBJECT'S LEGAL REPRESENTATIVE STATEMENT

I have read this consent form and have had a chance to ask questions about this research study. These questions have been answered to my satisfaction. If I have more questions about participation in this study or a research-related injury, I may contact the Study Doctor. By signing this consent form, I certify that all health information I have given is true and correct to the best of my knowledge.

I agree to participate in this study. I will be given a copy of this consent form with all the signatures for my own records.

CONSENT SIGNATURES

_____ _____

SUBJECT or SUBJECT'S LEGAL REPRESENTATIVE **DATE SIGNED**

_____ _____

PERSON OBTAINING CONSENT **DATE SIGNED**

I certify that I have explained the research, its purposes, and the procedures to the subject or subject's legal representative before requesting their signature.

Appendix B

Demographic Questions

1. What is your age: _____

2. Sex: Male Female

3. Grade/Level in School: _____

4. Race: Black White Asian Hispanic Native American Other

5. How many siblings (brothers or sisters) do you have: (circle one)

1 2 3 4 5 Other _____

6. If you have siblings, what are their ages: ____ ____ ____ ____ ____ ____

7. What class grade do you typically get: A B C D F (circle one)

8. How many of your friends smoke cigarettes? (Please circle one of the options below)

None Some Half Most All

9. How many of your male friends smoke cigarettes?
(Please circle one of the options below)

None Some Half Most All

10. How many of your female friends smoke cigarettes?
(Please circle one of the options below)

None Some Half Most All

11. How many of your siblings (from question 5) smoke cigarettes: _____

12. Does your mother smoke? (circle YES or NO)

13. Does your father smoke? (circle YES or NO)

14. Do any other caregivers smoke? (circle YES or NO)
If yes, which caregiver? For example stepfather, stepmother: _____

15. Not counting caregivers and siblings, how many members of your extended family (aunts, uncles, grandparents) smoke cigarettes? (Please circle one of the options below)

None Some Half Most All

16. Does your closest or best friend smoke cigarettes? (circle YES or NO)

17. Do you currently use any form of smokeless tobacco? (circle YES or NO)

18. Do you currently smoke cigarettes? (circle YES or NO)

FOR THIS STUDY

19. You will have the potential to earn between $20 and $30 in this study. For you, how important is it that you earn as close to $30 as possible? (Please circle from 1 to 10 below)

Not Important									Extremely Important
1	2	3	4	5	6	7	8	9	10

ANSWER QUESTIONS 20 THROUGH 23 ONLY IF YOU *SMOKE REGULARLY NOW*

20. For how long have you smoked cigarettes? _____

21. On average, how many cigarettes do you smoke a week? _____

22. When was your last cigarette? _____
a. 1-20 minutes ago
b. 21-30 minutes ago
c. 31-45 minutes ago
d. 46-60 minutes ago
e. more than 60 minutes ago

23. Do you want to quit? _____

Appendix C

BIS-11-A

Directions:

People differ in the ways they act and think in different situations. This is a test to measure some of the ways in which you act and think. Read each statement carefully and **CIRCLE THE APPROPRIATE NUMBER** to the right of the statement. Answer quickly and honestly.

		Rarely/ Never	Occasionally	Often	Almost Always/Always
1.	**I plan what I have to do**.	1	2	3	4
2.	**I do things without thinking**.	1	2	3	4
3.	**I make up my mind quickly**.	1	2	3	4
4.	**I am happy-go-lucky**.	1	2	3	4
5.	**I do not "pay attention"**.	1	2	3	4
6.	**My thoughts are racing too fast**. .	1	2	3	4
7.	**I plan my spare time**.	1	2	3	4
8.	**I am self controlled**.	1	2	3	4
9.	**I concentrate easily**.	1	2	3	4
10.	**I am a "saver"**.	1	2	3	4
11.	**I cannot stand still at movies or school**.	1	2	3	4
12.	**I like to think carefully about things**.	1	2	3	4
13.	**I plan for my future**.	1	2	3	4
14.	**I say things without thinking**.	1	2	3	4
15.	**I like to think about complex problems**.	1	2	3	4
16.	**I change my mind about what I will do when I grow up**.	1	2	3	4
17.	**I act "on impulse"**.	1	2	3	4
18.	**I get easily board when solving thought problems**.	1	2	3	4
19.	**I act on the spur of the moment**. . .	1	2	3	4

		Rarely/ Never	Occasionally	Often	Almost Always/Always
20.	**I am a great thinker**.	1	2	3	4
21.	**I change friends**.	1	2	3	4
22.	**I buy things on impulse**.	1	2	3	4
23.	**I can only think about one problem at a time**.	1	2	3	4
24.	**I change hobbies and sports**.	1	2	3	4
25.	**I spend more than I should**.	1	2	3	4
26.	**When I think about something, other thoughts pop up in my mind**	1	2	3	4
27.	**I am more interested in the present than in the future**.	1	2	3	4
28.	**I am restless at the movies or lectures**.	1	2	3	4
29.	**I like to play chess or checkers**. . . .	1	2	3	4
30.	**I am future oriented**.	1	2	3	4

Appendix D

Beck Depression Inventory

The Beck Depression Inventory (Beck, 1996) is copyrighted, so we are unable to include a copy of this measure. However, included is the description of the measure sent to the Institutional Review Board.

Beck Depression Inventory: Second Edition (BDI-II) (Beck, 1996). This is a 21 item self report questionnaire which assesses the symptoms and severity of depression according to American Psychiatric Association's *Diagnostic and Statistical Manual of Mental Disorders* Fourth Edition (DSM-IV; 1994). Each item represents a symptom of depression, and is scored on a 4 point scale (0-3). Each question asks the participant if the feelings have occurred for the "past two weeks-including today". The BDI-II was modified from the BDI based on changes in the DSM. The BDI- II is seen as more reliable compared to its first edition, based on the fact that the Coefficient Alpha (.92) of the BDI-II is higher than the BDI (.86). A total score of 0-13 is considered minimal range, 14-19 is mild, 20-28 is moderate, and 29-63 is severe. The BDI-II was compared against a standard for measuring depression in adolescents, the Reynolds Adolescent Depression Scale (II) and the correlation on the total scores of the measures was .84. (Krefetz et al, 2002).

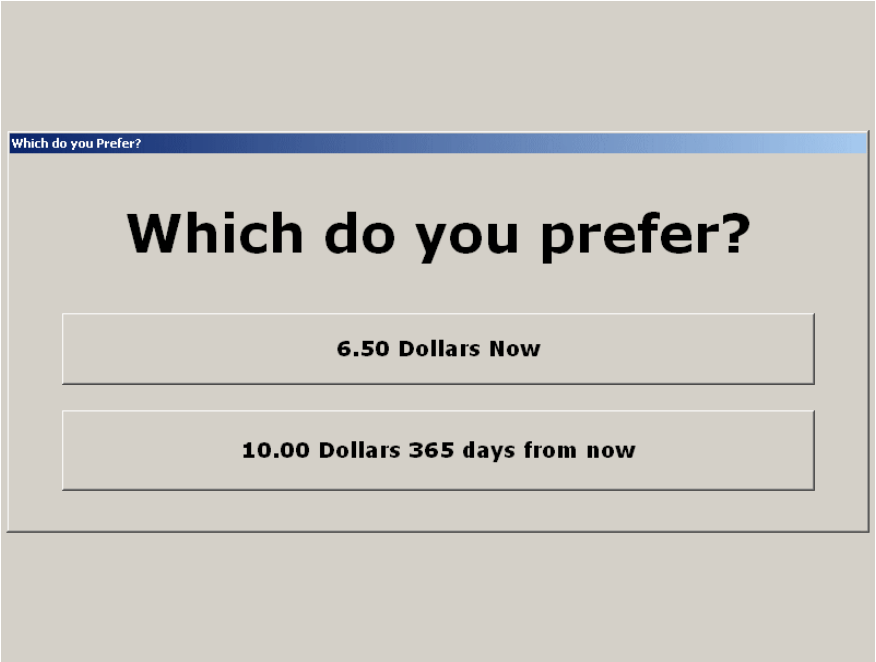
American Psychiatric Association (2002). Diagnostic and statistical manual of mental disorders (DSM-IV). 4th edition, text revision. Washington , DC: Author.

Beck, A. T., Steer, R. A., & Brown, G. K. (1996). Manual for Beck Depression Inventory-II. San Antonio, TX: Psychological Corporation.

Krefetz, D.G., Steer, R.A., Gulab, N.A., Beck, A.T. (2002). Convergent validity of the Beck Depression Inventory-II with the Reynolds Adolescent Depression Scale in psychiatric inpatients. *Journal of Personality Assessment. 78*, 451-460.

Appendix E

Delay Discounting



[Say]:
"*You will be choosing between different amounts of money available after different delays* ***OR*** *right now. There are no right or wrong answers to these questions…just pick what you prefer.* ***But****, the questions you answer are important because one of your answers will be selected at random and you will get what you chose. If you chose delayed money, the money will be put in an envelope with you name and address on it, and it will be mailed to you after the delay. For example if you chose $10 in 180 days from now, the $10 will be mailed to you in 180 days.*

In other words…..you're choosing between two options that are presented on the screen. There's no right or wrong answers so pick what you prefer. At the end, one of the questions will be picked and you will get what you chose. So if you chose $10 in 2 days, that money will be mailed to you in 2 days. If you chose $3 now, that money will be added into your total earnings for today.

Any Questions?

"*When you click on a choice, a box will pop up asking 'are you sure- yes or no' if you're sure of your choice, click yes, if not click no and it will bring you right back to the same question. Sometimes the 'yes' and 'no' boxes switch sides so be aware of that when clicking.*"

Appendix F

Go-Stop Task

1. For this task, you need to pay attention and remember numbers. This card shows you what the computer screen will look like during your session. Like you see on the card here, the numbers will be black against a white background. The 3 digit numbers appear on the screen one right after another.

2. If the numbers match, like this one matches the number you just saw…then you should click the left mouse button. But ONLY when the number you see is exactly the same as the one just before it.

3. If the numbers do not match ..like this one…doesn't match the last one, then do not click the mouse button.

4. Ok….this is the important part, whenever you respond (or click) to a number, you must click while that number is still on the screen. Clicking after the number is disappears from the screen does not count.

5. Another tricky part is that sometimes a number that matches the one you just saw will change from black to red. Do NOT click on any number that changes to red.

6. During your session you will have a short rest break. The screen will show you a message that tells you how many cents you've earned, how many cents you've lost, and then it will say "Please Rest"….during this time just sit and rest.

7. Just before the end of the break a message will tell you to "get ready". When you see this message, watch the screen for the next part of the session to start. You will do the same thing during all parts of the session….clicking on the matching numbers while they are still on the screen, as long as they don't turn red.

8. You will be paid for this session based on how accurately you perform…clicking the mouse when you are supposed to, and NOT clicking the mouse when you're not supposed to. When the session is over a message will tell you how much money you earned and how much money you lost during your session.

9. Do you have any questions?

Appendix G

Time Line Follow Back

Instructions

Prior to the interview:

1) *Select the calendars you'll need (if you are doing an interview on December 1 you will need the calendars for November and December).*
2) *The assessment window is 14 days long. It begins the day prior to the appointment date (count this as day 1) and goes back 13 more days (to day 14). Highlight the beginning and ending dates.*

Data collection objectives:

1) *For each day of the 14 day window record the # of cigarettes per day on the appropriate line.*

Interview:

"Now we are going to begin the questionnaire part of the project. I want to remind you that the information that you provide will not be shared with anyone outside of the project's staff. I ask that you be as honest as you can when answering these questions. Ask me any questions you may have as we go through the questionnaires.

"I am going to ask you to recall the number of cigarettes, bidis and flavored cigarettes you have smoked in the last 14 days, starting with yesterday. I just want to get an idea of how many cigarettes you have smoked per day during this time period. This is not a difficult task, especially when you use this calendar and work your way back each day. I realize that it's hard to recall with 100 % accuracy, but just try to be as accurate as possible. When you are unsure, give it your best guess. The important thing is that you provide your best estimate for each day."

Appendix H

Substance-Use Questionnaire

Thinking about the past *six months*, how often have you used the following substances?

	Never Tried	Tried it	1-2x/ month	Once a week	2-4x/ week	5 or more x/ week
ALCOHOL (Beer /mixed drinks/etc.)	**0**	**1**	**2**	**3**	**4**	**5**
MARIJUANA (Pot/grass/hashish)	**0**	**1**	**2**	**3**	**4**	**5**
CLUB DRUGS (Ecstasy, GHB, Ketamne)	**0**	**1**	**2**	**3**	**4**	**5**
OPIATES (Heroin/morphine/ demorol/codine)	**0**	**1**	**2**	**3**	**4**	**5**
CAFFEINE	**0**	**1**	**2**	**3**	**4**	**5**
BARBITURATES (Downers/sleeping pills)	**0**	**1**	**2**	**3**	**4**	**5**
CIGARETTES	**0**	**1**	**2**	**3**	**4**	**5**
TRANQUILIZERS (Valium, Librium)	**0**	**1**	**2**	**3**	**4**	**5**
COCAINE, CRACK	**0**	**1**	**2**	**3**	**4**	**5**
AMPHETAMINES (Uppers/speed)	**0**	**1**	**2**	**3**	**4**	**5**
CRYSTAL METH (Ice/crystal)	**0**	**1**	**2**	**3**	**4**	**5**
RITALIN	**0**	**1**	**2**	**3**	**4**	**5**
PSYCHEDELICS (LSD/Mescaline/peyote)	**0**	**1**	**2**	**3**	**4**	**5**